Intermediate Data Format Specification

PADS 9.4

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Chapter 1
Introduction

This manual describes the Intermediate Data Format that is used by the PCB Mechanical Interface.

Intermediate Data Format Structure

The Intermediate Data Format consists of three files: board file, library file, and panel file. The board file contains a description of a single PCB, including the board shape, layout restrictions, and component placement. The library file contains descriptions of components used by one or more PCBs. The panel file contains a description of a manufacturing panel including the panel shape, layout restrictions, and the placement of boards and components on the panel.

Data is organized by sections in these files. Each section begins with a keyword indicating the type of data the section contains, and a matching keyword at the end of the section. All data between the section keyword and its corresponding ending keyword pertains to that section. Sections cannot be nested. Unless otherwise noted, sections within a file can be in any order.

Data within the sections is represented by one or more records consisting of one or more fields. Each line in a file is a separate record; fields within a record are separated by one or more blanks. Records within a section and fields within a record must be in a specific order. Records are free format which means that the fields they contain can be any length, and each field can begin in any column if the order of fields is maintained.

General Format Rules

The following general rules apply to the Intermediate Data Format:

- Sections are delimited by keywords beginning with a period (.).

- Records are delimited by a single new line character.

- Fields within a record are delimited by one or more space characters.

- Records and fields can be any length.

- Three data types are supported: string, float, and integer.

- Strings containing blank characters must be delimited by surrounding them with double quotes (").

- Keyword strings are not case sensitive; they are generally capitalized to enhance readability.

- The case sensitivity of value strings is determined by the sending and receiving systems. Therefore, it is best to maintain the case of value strings.

- The comment character is the pound sign (#). A comment must be a separate line (record), and the comment character must be in column 1. Comments must be located between, but not within sections of the IDF files.

Notes for Using IDF 3.0

The following design restrictions are known limitations for IDF 3.0:

1. The Owner record for outlines, keepouts, regions and drilled holes is not supported by Board Station. When exporting, this information is set to UNOWNED by default. When importing, the owner information set by the mechanical system is lost.

2. Placement Outline: Layer information for the placement outline is lost during import.

3. Placement Outline: When importing, any height restriction imposed by the mechanical system is discarded.

4. Routing Outline: While importing, if more than one routing outline is available, the priority for reading in the outlines is: ALL, BOTH, TOP, BOTTOM, INNER. For example, if the mechanical system defines two routing outlines, one applicable to the TOP and another one for the INNER layers, Board Station reads only the routing outline defined for the TOP layer. The information regarding the INNER layer one is discarded. This can lead to loss of data during round trip data transfers

5. Routing Keepout: The routing keepout for INNER layers is not imported.

6. Drilled Holes: The hole types PIN and VIA are not supported and are lost during import.

7. NOTES: The text present on Drawing_1 layer is exported as NOTES. While importing, any text present inthe NOTES section is imported to Drawing_1 layer.

8. Component placement section: Board Station does not support the concept of mounting offset for components on the board or for boards on a panel.While exporting, Board Station outputs 0 value for this data; while importing, this value is read and ignored.

9. Component Placement section: If the placement status is MCAD or ECAD, that component is treated as FIXED by Board Station during import.

10. Panel File: Board Station supports only the following data in the panel file for both import and export.

 Header
 Panel Outline
 Placement region
 Routing keepout
 Via Keepout
 Other Outline

Place keepout
Drilled Holes
Notes
Placement

Any other data, if present, is lost during import.

11. The IDF file format accepts 80 characters in the geometry name. Some mechanical tools do not support strings of this length. In such cases, you must use the alias mechanism to support longer strings. The following is an awk script that can be used to alias the geometry names.

```
BEGIN {
  Section = "";
  bogus_cnt = 0;
  geom = "";
}
{
```

The board file contains the physical description of the PCB and the locations of components that are placed on the board. The physical descriptions for the components are contained in the library file and referenced by the board file.

The board file contains the following sections:

Header — for information on the board file

Board outline — for defining the outline, cutouts, and thickness of the board

Other outline — for defining the outline, cutouts, and thickness of another outline

Routing outline — for defining an area to route electrical connections

Placement outline — for defining an area within which to place components

Routing keepout — for defining an area within which routing is not allowed

Via keepout — for defining an area within which vias are not allowed

Placement keepout — for defining an area within which electrical components are not allowed

Placement group area region — for defining an area to place similar electrical components

Drilled holes — for defining drilled holes in the board

Notes — for defining annotations to communicate additional information between designers

Placement — for defining the locations of components on the board

The Header section must be the first section in the file. The board outline must be the second section, and the Placement section must be the last section. All other sections can be in any order.

The following pages describe these sections. See also "Board File Example".

Board File Header Section

This section contains information on the board file.

Record 1

Field	Description	Type	Value
1	Section keyword	string	.HEADER

Record 2

Field	Description	Type	Value
1	File type	string	BOARD_FILE
2	IDF version number	float	1.0 First version 2.0 Previous version 3.0 This version
3	Source system identification	string	Any Example: "ACME CAD rel. 5.0"
4	Date	string	format = yyyy/mm/dd.hh:mm:ss
5	Board File version #	integer	Any

Record 3

Field	Description	Type	Value
1	Board name	string	Any
2	Units definition	string	MM—millimeters THOU—mils (thousandths of an inch)

The units specified in Field 2 apply to all values in the board file.

Record 4

Field	Description	Type	Value
1	Section end keyword	string	.END_HEADER

Board Outline Section

This section defines the board outline and its internal cutouts as a 2D profile with thickness. The board outline and cutouts consist of simple closed curves made up of arcs and lines. Only one board outline may be specified, but multiple cutouts are allowed.

Record 1

Field	Description	Type	Value	
1	Section keyword	string	.BOARD_OUTLINE .PANEL_OUTLINE	
2	Outline owner	string	MCAD	Outline is owned by the Mechanical system and must not be modified in the Electrical system.
			ECAD	Outline is owned by the Electrical system and must not be modified in the Mechanical system.
			UNOWNED	Outline can be modified in either system

Record 2

Field	Description	Type	Value
1	Board thickness	float	Any

Record 3

Field	Description	Type	Value	
1	Loop label	integer	0	Specifies board outline points in counter-clockwise direction.
			1	Specifies board cutout points in clockwise direction.
			n	Labels additional board cutouts sequentially from one
2	X coordinate of point	float	Any	
3	Y coordinate of point	float	Any	
4	Include angle (degrees)	float	0	Creates a straight line between X_{n-1}, Y_{n-1} and X_n, Y_n.
			#0	Creates an arc between X_{n-1}, Y_{n-1} and X_n, Y_n. If positive, the arc is counter-clockwise.
			360	Creates a circle with center at X_{n-1}, Y_{n-1} with X_n, Y_n a point on the circle. A circle is considered an entire loop.

Record 3 is repeated for each point that defines the board outline or a cutout on the board. For each loop (outline or cutout), the last pair of coordinates must be the same as the first.

Record 4

Field	Description	Type	Value
1	Section end keyword	string	.END_BOARD_OUTLINE .END_PANEL_OUTLINE

Other Outline Section

This section defines an additional outline with cutouts that can be used for purposes other than the board outline, for example, it can be used for defining a heatsink or board core. The outline and cutouts consist of simple closed curves made up of arcs and lines. Multiple other outline sections may be specified.

Record 1

Field	Description	Type	Value	
1	Section keyword	string	.OTHER_OUTLINE	
2	Outline owner	string	MCAD	Outline is owned by the Mechanical system and must not be modified in the Electrical system.
			ECAD	Outline is owned by the Electrical system and must not be modified in the Mechanical system.
			UNOWNED	Outline can be modified in either system

Record 2

Field	Description	Type	Value	
1	Outline identifier	string	Any	Unique identifier for the outline, such as a part name or layer name
2	Extrude thickness	float	Any (≥0)	
3	board side	string	TOP	Other outline is on top of the board
			BOTTOM	Other outline is on bottom of the board

Record 3

Field	Description	Type	Value	
1	Loop label	integer	0	Outline points specified in counter-clockwise direction.
			1	Cutout points specified in clockwise direction.
			n	Additional cutouts are labeled sequentially from one.
2	X coordinate of point	float	Any	
3	Y coordinate of point	float	Any	

Field	Description	Type	Value	
4	Include angle (degrees)	float	0	Creates a straight line between X_{n-1}, Y_{n-1} and X_n, Y_n.
			#0	Creates an arc between X_{n-1}, Y_{n-1} and X_n, Y_n. If positive, the arc is counter-clockwise.
			360	Creates a circle with the center at X_{n-1}, Y_{n-1} with X_n, Y_n a point on the circle. A circle is considered an entire loop.

Record 3 is repeated for each point that defines the outline or its cutouts. For each loop (outline or cutout), the last pair of coordinates must be the same as the first.

Record 4

Field	Description	Type	Value
1	Section end keyword	string	.END_OTHER_OUTLINE

Routing Outline Section

This section defines a routing outline for the board. Each routing outline specifies a region of the board within which routing must be confined. The Routing outline consists of a simple closed curve made up of arcs and lines. Multiple, non-overlapping routing outlines may be defined.

Record 1

Field	Description	Type	Value	
1	Section keyword	string	.ROUTE_OUTLINE	
2	Outline owner	string	MCAD	Outline is owned by the Mechanical system and must not be modified in the Electrical system.
			ECAD	Outline is owned by the Electrical system and must not be modified in the Mechanical system.
			UNOWNED	Outline can be modified in either system

Record 2

Field	Description	Type	Value	
1	Routing layers	string	TOP	Outline applies to top routing layer only.
			BOTTOM	Outline applies to bottom routing layer only.
			BOTH	Outline applies to both top and bottom routing layers.
			INNER	Outline applies to the inner routing layers of the board only.
			ALL	Outline applies to all routing layers

Record 3

Field	Description	Type	Value	
1	Loop label	integer	0	Specifies points in counter-clockwise direction
			1	Specifies points in clockwise direction
2	X coordinate of point	float	Any	
3	Y coordinate of point	float	Any	

Field	Description	Type	Value	
4	Include angle (degrees)	float	0	Creates a straight line between X_{n-1}, Y_{n-1} and X_n, Y_n.
			#0	Creates an arc between X_{n-1}, Y_{n-1} and X_n, Y_n. If positive, the arc is counter-clockwise.
			360	Creates a circle with the center at X_{n-1}, Y_{n-1} with X_n, Y_n a point on the circle. A circle is considered an entire loop.

All X and Y coordinate values are absolute (relative to the board origin). Record 3 is repeated for each point that defines the routing outline. The last pair of coordinates must be the same as the first.

Record 4

Field	Description	Type	Value
1	Section end keyword	string	.END_ROUTE_OUTLINE

Placement Outline Section

This section defines a placement outline for the board. Each placement outline specifies a region of the board within which components must be placed. The Placement outline consists of a simple closed curve made up of arcs and lines. Multiple, non-overlapping placement outlines may be defined.

Record 1

Field	Description	Type	Value	
1	Section keyword	string	.PLACE_OUTLINE	
2	Outline owner	string	MCAD	Outline is owned by the Mechanical system and must not be modified in the Electrical system.
			ECAD	Outline is owned by the Electrical system and must not be modified in the Mechanical system.
			UNOWNED	Outline can be modified in either system.

Record 2

Field	Description	Type	Value	
1	Board side	string	TOP	Outline applies to top side of board only.
			BOTTOM	Outline applies to bottom side of board only.
			BOTH	Outline applies to both sides of board.
2	Outline height	float	Any (≥0)	

The outline height is used to exclude components from the outline that, when mounted, exceed this height. If this field is missing, there is no height restriction on the outline.

Record 3

Field	Description	Type	Value	
1	Loop label	integer	0	Specifies points in counter-clockwise direction.
			1	Specifies points in clockwise direction.
2	X coordinate of point	float	Any	Relative to the board or panel origin
3	Y coordinate of point	float	Any	Relative to the board or panel origin
4	Include angle (degrees)	float	0	Creates a straight line between X_{n-1}, Y_{n-1} and X_n, Y_n.
			#0	Creates an arc between X_{n-1}, Y_{n-1} and X_n, Y_n. If positive, the arc is counter-clockwise.
			360	Creates a circle with the center at X_{n-1}, Y_{n-1} with X_n, Y_n a point on the circle. A circle is considered an entire loop.

Record 3 is repeated for each point that defines the placement outline. The last pair of coordinates must be the same as the first.

Record 4

Field	Description	Type	Value
1	Section end keyword	string	.END_PLACE_OUTLINE

Routing Keepout Section

This section defines a routing keepout for the board or panel. Routing keepouts specify regions where routing is not allowed. Routing keepouts can exist on top, bottom, both top and bottom, or all routing layers. Each keepout consists of a simple closed curve made up of arcs and lines. Portions of routing keepouts on a panel that lie on a board in the panel are inherited by that board. Multiple keepouts are allowed

Record 1

Field	Description	Type	Value	
1	Section keyword	string	.ROUTE_KEEPOUT	
2	Keepout owner	string	MCAD	Outline is owned by the Mechanical system and must not be modified in the Electrical system.
			ECAD	Outline is owned by the Electrical system and must not be modified in the Mechanical system.
			UNOWNED	Outline can be modified in either system

Record 2

Field	Description	Type	Value	
1	Routing layers	string	TOP	Keepout applies to top routing layer only.
			BOTTOM	Keepout applies to bottom routing layer only.
			BOTH	Keepout applies to both top and bottom routing layers.
			INNER	Outline applies to the inner routing layers only.
			ALL	Keepout applies to all routing layers

Record 3

Field	Description	Type	Value	
1	Loop label	integer	0	Specifies points in counter-clockwise direction.
			1	Specifies points in clockwise direction.
2	X coordinate of point	float	Any	Relative to the board or panel origin
3	Y coordinate of point	float	Any	Relative to the board or panel origin

Field	Description	Type	Value	
4	Include angle (degrees)	float	0	Creates a straight line between X_{n-1}, Y_{n-1} and X_n, Y_n.
			#0	Creates an arc between X_{n-1}, Y_{n-1} and X_n, Y_n. If positive, the arc is counter-clockwise.
			360	Creates a circle with the center at X_{n-1}, Y_{n-1} with X_n, Y_n a point on the circle. A circle is considered an entire loop.

Record 3 is repeated for each point that defines the routing keepout. The last pair of coordinates must be the same as the first.

Record 4

Field	Description	Type	Value
1	Section end keyword	string	.END_ROUTE_KEEPOUT

Via Keepout Section

This section defines a via keepout for the board or panel. Via keepouts specify regions where vias are not allowed (although routing is still allowed). Each keepout consists of a simple closed curve made up of arcs and lines. Portions of via keepouts on a panel that lie on a board in the panel are inherited by that board. Multiple via keepouts are allowed. Only through vias (vias that go all the way through the board) are supported.

Record 1

Field	Description	Type	Value	
1	Section keyword	string	.VIA_KEEPOUT	
2	Keepout owner	string	MCAD	Outline is owned by the Mechanical system and must not be modified in the Electrical system.
			ECAD	Outline is owned by the Electrical system and must not be modified in the Mechanical system.
			UNOWNED	Outline can be modified in either system.

Record 2

Field	Description	Type	Value	
1	Loop label	integer	0	Specifies points in counter-clockwise direction.
			1	Specifies points in clockwise direction.
2	X coordinate of point	float	Any	Relative to the board or panel origin
3	Y coordinate of point	float	Any	Relative to the board or panel origin
4	Include angle (degrees)	float	0	Creates a straight line between X_{n-1}, Y_{n-1} and X_n, Y_n.
			#0	Creates an arc between X_{n-1}, Y_{n-1} and X_n, Y_n. If positive, the arc is counter-clockwise.
			360	Creates a circle with the center at X_{n-1}, Y_{n-1} with X_n, Y_n a point on the circle. A circle is considered an entire loop.

Record 2 is repeated for each point that defines the via keepout. The last pair of coordinates must be the same as the first.

Record 3

Field	Description	Type	Value
1	Section end keyword	string	.END_VIA_KEEPOUT

Placement Keepout Section

This section defines a placement keepout for the board or panel. Placement keepouts specify regions on the board where components cannot be placed. A keepout can apply to all components, or to only those components above a specified height. Placement keepouts can exist on the top, bottom, or both top and bottom of the board or panel. Each keepout consists of a simple closed curve made up of arcs and lines along with a height restriction. Portions of placement keepouts on a panel that lie on a board in the panel are inherited by that board. Multiple keepouts are allowed.

Record 1

Field	Description	Type	Value	
1	Section keyword	string	.PLACE_KEEPOUT	
2	Keepout owner	string	MCAD	Outline is owned by the Mechanical system and must not be modified in the Electrical system.
			ECAD	Outline is owned by the Electrical system and must not be modified in the Mechanical system.
			UNOWNED	Outline can be modified in either system.

Record 2

Field	Description	Type	Value	
1	Board side	string	TOP	Keepout applies to top side of board only
			BOTTOM	Keepout applies to bottom side of board only
			BOTH	Keepout applies to both sides of board
2	Keepout height	float	Any (≥ 0)	

The keepout height is used to exclude components from the keepout that, when mounted, exceed this height. A value of 0.0 indicates that all components are excluded from the keepout.

Record 3

Field	Description	Type	Value	
1	Loop label	integer	0	Specifies points in a counter-clockwise direction.
			1	Specifies points in a clockwise direction.
2	X coordinate of point	float	Any	
3	Y coordinate of point	float	Any	
4	Include angle (degrees)	float	0	Creates a straight line between X_{n-1}, Y_{n-1} and X_n, Y_n.
			#0	Creates an arc between X_{n-1}, Y_{n-1} and X_n, Y_n. If positive, the arc is counter-clockwise.
			360	Creates a circle with the center at X_{n-1}, Y_{n-1} with X_n, Y_n a point on the circle. A circle is considered an entire loop.

Record 3 is repeated for each point that defines the placement keepout. The last pair of coordinates must be the same as the first.

Record 4

Field	Description	Type	Value
1	Section end keyword	string	.END_PLACE_KEEPOUT

Placement Group Area Section

This section specifies an area of the board for placement of a group of similar components. For example, you might place all analog components in a particular area for thermal considerations. Each placement group area consists of a simple closed curve made up of arcs, lines, and a name designating the group of components to place in that area. Multiple, overlapping areas are allowed.

Record 1

Field	Description	Type	Value	
1	Section keyword	string	.PLACE_REGION	
2	Region owner	string	MCAD	Region is owned by the Mechanical system and must not be modified in the Electrical system.
			ECAD	Region is owned by the Electrical system and must not be modified in the Mechanical system.
			UNOWNED	Region can be modified in either system

Record 2

Field	Description	Type	Value	
1	Board side	string	TOP	Group area applies to top side of board only
			BOTTOM	Group area applies to bottom of board only.
			BOTH	Group area applies to both sides of board.
2	Component group name	string	Any	

Record 3

Field	Description	Type	Value	
1	Loop label	integer	0	Specifies points in counter-clockwise direction
			1	Specifies points in clockwise direction
2	X coordinate of point	float	Any	Relative to the board or panel origin
3	Y coordinate of point	float	Any	Relative to the board or panel origin

Field	Description	Type	Value	
4	Include angle (degrees)	float	0	Creates a straight line between X_{n-1}, Y_{n-1} and X_n, Y_n.
			#0	Creates an arc between X_{n-1}, Y_{n-1} and X_n, Y_n. If positive, the arc is counter-clockwise.
			360	Creates a circle with the center at X_{n-1}, Y_{n-1} with X_n, Y_n a point on the circle. A circle is considered an entire loop.

Record 3 is repeated for each point that defines the group area keepout. The last pair of coordinates must be the same as the first.

Record 4

Field	Description	Type	Value
1	Section end keyword	string	.END_PLACE_REGION

Drilled Holes Section

This section specifies holes that are to be drilled in the board for mounting or tooling purposes. Drilled holes are distinguished from circular cutouts in the board outline in that they are always drilled (not punched or routed) and can be plated with conductor. This section appears only once in the board file, but multiple, non-overlapping holes are allowed.

Record 1

Field	Description	Type	Value
1	Section keyword	string	.DRILLED_HOLES

Record 2

Field	Description	Type	Value	
1	Hole diameter	float	Any	
2	X coordinate of center	float	Any	
3	Y coordinate of center	float	Any	
4	Plating style	string	PTH NPTH	Plated (conducting) through hole Non-plated (non-conducting) through hole
5	Associated parts	string	BOARD NOREFDES PANEL Reference Designator	Defines a hole in the board part. Defines a hole in a non-electrical part. Defines a hole in a panel part. Reference designator of the electrical component in which hole is defined
6	Hole type	string	PIN VIA MTG TOOL Other	Hole is for a component pin. Hole is for a conductive via. Hole is for mounting purposes. Hole is for tooling purposes. User-defined.
7	Hole owner	string	MCAD ECAD UNOWNED	Hole is owned by the Mechanical system and must not be modified in the Electrical system. Hole is owned by the Electrical system and must not be modified in the Mechanical system Hole can be modified in either system

All X and Y coordinate values are absolute (relative to the board or panel origin). Record 2 is repeated for each drilled hole.

Record 3

Field	Description	Type	Value
1	Section end keyword	string	.END_DRILLED_HOLES

Notes Section

This section contains notes for the design that can be displayed in the receiving system, to allow the electrical and mechanical designers to communicate additional information about the design entities beyond that conveyed by the entities themselves. Notes are not intended for rigorous translations of text such as for transferring manufacturing drawings. The association of a note to its subject is inferred by its location.

Record 1

Field	Description	Type	Value
1	Section keyword	string	.NOTES

Record 2

Field	Description	Type	Value
1	X coordinate of text	float	Any Bottom left justification is assumed.
2	Y coordinate of text	float	Any Bottom left justification is assumed.
3	Text height	float	Any Board or panel units are assumed.
4	Text string physical length	float	Any Board or panel units are assumed.
5	Text value	string	Any

Record 3

Field	Description	Type	Value
1	Section end keyword	string	.END_NOTES

Component Placement Section

This section specifies the locations of all components on the board, and boards and components on a panel. A location consists of an X coordinate and Y coordinate relative to the board or panel origin, a mounting offset, a rotation about the component origin, and a side of the board or panel. Components can be either placed or unplaced. Placed components can be owned by the system (electrical or mechanical) that specified their locations to prevent changes being made to their placement in the receiving system.

The package name and part number fields in Record 2 for each component are used to reference the component description in the library file.

Record 1

Field	Description	Type	Value
1	Section keyword	string	.PLACEMENT

Record 2

Field	Description	Type	Value	
1	Package name	string	Any	Part name for package geometry
2	Part number	string	Any	Component part number
3	Reference Designator	string	Any	Electrical component instance reference designator.
			NOREFDES	Instance is a mechanical component.
			BOARD	Instance is a board on a panel.

Record 3

Field	Description	Type	Value	
1	X coordinate of location	float	Any	
2	Y coordinate of location	float	Any	
3	Mounting offset	float	Any (≥0) Mounting offset from board surface	
4	Rotation angle (degrees)	float	Any	
5	Side of board	string	TOP	Component is placed on the top of the board.
			BOTTOM	Component is placed on the bottom of the board.
6	Placement status	string	FIXED	Component location is fixed and cannot be moved
			UNPLACED	Component is currently unplaced.
			PLACED	Component is placed but not fixed.

A component is located by first moving its origin to the specified X,Y coordinates. (All X and Y

coordinate values are absolute, relative to the board or panel origin). If the component is on the bottom of the board or panel, it is flipped around its local Y axis. Finally, the component is rotated the specified amount about its origin (positive rotations are counter-clockwise, relative to the component's coordinate system).

If the value of field 6 of record 3 is UNPLACED, the values in fields 1-5 are ignored. Records 2 and 3 are repeated for each component on the board.

Record 4

Field	Description	Type	Value
1	Section end keyword	string	.END_PLACEMENT

Board File Example

```
.HEADER
BOARD_FILE  3.0  "Sample File Generator"  10/22/96.16:02:44  1
sample_board  THOU
.END_HEADER
.BOARD_OUTLINE          MCAD
62.0
0    5030.5  -120.0     0.0
0    5187.5  -120.0     0.0
0    5187.5  2130.0     0.0
0    5155.0  2130.0     0.0
0    5155.0  2550.0  -180.0
0    5187.5  2550.0     0.0
0    5187.5  4935.0     0.0
0    4945.0  5145.0     0.0
0    4945.0  5420.0     0.0
0    4865.0  5500.0     0.0
0     210.0  5500.0     0.0
0     130.0  5420.0     0.0
0     130.0  5145.0     0.0
0   -112.5  4935.0     0.0
0   -112.5  2550.0     0.0
0    -80.0  2550.0     0.0
0    -80.0  2130.0  -180.0
0   -112.5  2130.0     0.0
0   -112.5  -140.0     0.0
0     45.5  -140.0     0.0
0     45.5  -400.0     0.0
0   2442.5  -400.0     0.0
0   2442.5  -140.0     0.0
0   2631.5  -140.0     0.0
0   2631.5  -400.0     0.0
0   5030.5  -400.0     0.0
0   5030.5  -120.0     0.0
1   2650.0  2350.0     0.0
1   3000.0  2350.0   360.0
.END_BOARD_OUTLINE
.ROUTE_OUTLINE          ECAD
ALL
0   5112.5   150.0     0.0
0   5112.5  2058.2     0.0
0   5112.5  2621.8  -162.9
0   5112.5  4863.2     0.0
0   4878.8  5075.0     0.0
0    226.4  5075.0     0.0
0    138.0  4910.3     0.0
0    138.0  4800.0     0.0
0    -37.5  4662.5     0.0
0    -37.5  2621.8     0.0
0    -37.5  2058.2  -162.9
0    -37.5   150.0     0.0
0    162.5     0.0     0.0
0   4912.5     0.0     0.0
0   5112.5   150.0     0.0
.END_ROUTE_OUTLINE
```

```
.PLACE_OUTLINE          MCAD
TOP            1000.0
0    5080.0  2034.9     0.0
0    5080.0  2645.1  -152.9
0    5080.0  4837.3     0.0
0    4855.3  5042.5     0.0
0     252.9  5042.5     0.0
0     170.5  4896.9     0.0
0     170.5  4798.4     0.0
0      -5.0  4659.0     0.0
0      -5.0  2645.1     0.0
0      -5.0  2034.9  -152.9
0      -5.0   182.5     0.0
0     192.0    32.5     0.0
0    4883.1    32.5     0.0
0    5080.0   182.5     0.0
0    5080.0  2034.9     0.0
.END_PLACE_OUTLINE
.PLACE_OUTLINE          UNOWNED
BOTTOM         200.0
0     300.0   200.0     0.0
0    4800.0   200.0     0.0
0    4800.0  4800.0     0.0
0     300.0  4800.0     0.0
0     300.0   200.0     0.0
.END_PLACE_OUTLINE
.ROUTE_KEEPOUT          ECAD
ALL
0    2650.0  2350.0     0.0
0    3100.0  2350.0   360.0
.END_ROUTE_KEEPOUT
.PLACE_KEEPOUT          MCAD
BOTH            0.0
0    2650.0  2350.0     0.0
0    3100.0  2350.0   360.0
.END_PLACE_KEEPOUT
.PLACE_KEEPOUT          MCAD
TOP            300.0
0    3700.0  5000.0     0.0
0    3700.0  4300.0     0.0
0    4000.0  4300.0     0.0
0    4000.0  3700.0     0.0
0    5000.0  3700.0     0.0
0    5000.0  4800.0     0.0
0    4800.0  5000.0     0.0
0    3700.0  5000.0     0.0
.END_PLACE_KEEPOUT
.DRILLED_HOLES
     30.0  1800.0   100.0      PTH      J1      PIN      ECAD
     30.0  1700.0   100.0      PTH      J1      PIN      ECAD
     30.0  1600.0   100.0      PTH      J1      PIN      ECAD
     30.0  1500.0   100.0      PTH      J1      PIN      ECAD
     30.0  1400.0   100.0      PTH      J1      PIN      ECAD
     30.0  1300.0   100.0      PTH      J1      PIN      ECAD
     30.0  1200.0   100.0      PTH      J1      PIN      ECAD
     30.0  1100.0   100.0      PTH      J1      PIN      ECAD
     30.0  1000.0   100.0      PTH      J1      PIN      ECAD
     30.0  0900.0   100.0      PTH      J1      PIN      ECAD
```

```
30.0   0800.0   100.0    PTH    J1    PIN    ECAD
30.0   0700.0   100.0    PTH    J1    PIN    ECAD
30.0   0700.0   200.0    PTH    J1    PIN    ECAD
30.0   0800.0   200.0    PTH    J1    PIN    ECAD
30.0   0900.0   200.0    PTH    J1    PIN    ECAD
30.0   1000.0   200.0    PTH    J1    PIN    ECAD
30.0   1100.0   200.0    PTH    J1    PIN    ECAD
30.0   1200.0   200.0    PTH    J1    PIN    ECAD
30.0   1300.0   200.0    PTH    J1    PIN    ECAD
30.0   1400.0   200.0    PTH    J1    PIN    ECAD
30.0   1500.0   200.0    PTH    J1    PIN    ECAD
30.0   1600.0   200.0    PTH    J1    PIN    ECAD
30.0   1700.0   200.0    PTH    J1    PIN    ECAD
30.0   1800.0   200.0    PTH    J1    PIN    ECAD
30.0   4400.0   100.0    PTH    J2    PIN    ECAD
30.0   4300.0   100.0    PTH    J2    PIN    ECAD
30.0   4200.0   100.0    PTH    J2    PIN    ECAD
30.0   4100.0   100.0    PTH    J2    PIN    ECAD
30.0   4000.0   100.0    PTH    J2    PIN    ECAD
30.0   3900.0   100.0    PTH    J2    PIN    ECAD
30.0   3800.0   100.0    PTH    J2    PIN    ECAD
30.0   3700.0   100.0    PTH    J2    PIN    ECAD
30.0   3600.0   100.0    PTH    J2    PIN    ECAD
30.0   3500.0   100.0    PTH    J2    PIN    ECAD
30.0   3400.0   100.0    PTH    J2    PIN    ECAD
30.0   3300.0   100.0    PTH    J2    PIN    ECAD
30.0   3300.0   200.0    PTH    J2    PIN    ECAD
30.0   3400.0   200.0    PTH    J2    PIN    ECAD
30.0   3500.0   200.0    PTH    J2    PIN    ECAD
30.0   3600.0   200.0    PTH    J2    PIN    ECAD
30.0   3700.0   200.0    PTH    J2    PIN    ECAD
30.0   3800.0   200.0    PTH    J2    PIN    ECAD
30.0   3900.0   200.0    PTH    J2    PIN    ECAD
30.0   4000.0   200.0    PTH    J2    PIN    ECAD
30.0   4100.0   200.0    PTH    J2    PIN    ECAD
30.0   4200.0   200.0    PTH    J2    PIN    ECAD
30.0   4300.0   200.0    PTH    J2    PIN    ECAD
30.0   4400.0   200.0    PTH    J2    PIN    ECAD
30.0   3000.0   3300.0   PTH    U3    PIN    ECAD
30.0   3024.2   3203.0   PTH    U3    PIN    ECAD
30.0   3048.4   3105.9   PTH    U3    PIN    ECAD
30.0   3072.6   3008.9   PTH    U3    PIN    ECAD
30.0   3096.8   2911.9   PTH    U3    PIN    ECAD
30.0   3121.0   2814.9   PTH    U3    PIN    ECAD
30.0   3145.2   2717.8   PTH    U3    PIN    ECAD
30.0   3436.2   2790.4   PTH    U3    PIN    ECAD
30.0   3412.1   2887.4   PTH    U3    PIN    ECAD
30.0   3387.9   2984.5   PTH    U3    PIN    ECAD
30.0   3363.7   3081.5   PTH    U3    PIN    ECAD
30.0   3339.5   3178.5   PTH    U3    PIN    ECAD
30.0   3315.3   3275.6   PTH    U3    PIN    ECAD
30.0   3291.1   3372.6   PTH    U3    PIN    ECAD
30.0   2200.0   2500.0   PTH    U4    PIN    ECAD
30.0   2100.0   2500.0   PTH    U4    PIN    ECAD
30.0   2000.0   2500.0   PTH    U4    PIN    ECAD
30.0   1900.0   2500.0   PTH    U4    PIN    ECAD
30.0   1800.0   2500.0   PTH    U4    PIN    ECAD
30.0   1700.0   2500.0   PTH    U4    PIN    ECAD
```

```
       30.0   1600.0   2500.0      PTH      U4      PIN      ECAD
       30.0   1600.0   2200.0      PTH      U4      PIN      ECAD
       30.0   1700.0   2200.0      PTH      U4      PIN      ECAD
       30.0   1800.0   2200.0      PTH      U4      PIN      ECAD
       30.0   1900.0   2200.0      PTH      U4      PIN      ECAD
       30.0   2000.0   2200.0      PTH      U4      PIN      ECAD
       30.0   2100.0   2200.0      PTH      U4      PIN      ECAD
       30.0   2200.0   2200.0      PTH      U4      PIN      ECAD
       20.0   2500.0   3100.0      PTH    BOARD     VIA      ECAD
       20.0   2500.0   3200.0      PTH    BOARD     VIA      ECAD
       20.0   2500.0   3300.0      PTH    BOARD     VIA      ECAD
       20.0   2000.0   1600.0      PTH    BOARD     VIA      ECAD
       20.0   1100.0   0900.0      PTH    BOARD     VIA      ECAD
       20.0   1200.0   1600.0      PTH    BOARD     VIA      ECAD
       20.0   3900.0   3800.0      PTH    BOARD     VIA      ECAD
       20.0   3900.0   2300.0      PTH    BOARD     VIA      ECAD
      100.0   3100.0    -50.0     NPTH      J2      MTG      ECAD
      100.0   4600.0    -50.0     NPTH      J2      MTG      ECAD
      100.0    500.0    -50.0     NPTH      J1      MTG      ECAD
      100.0   2000.0    -50.0     NPTH      J1      MTG      ECAD
       93.0   5075.0      0.0      PTH    BOARD     MTG   UNOWNED
       93.0      0.0   4800.0     NPTH    BOARD    TOOL      MCAD
       93.0      0.0      0.0      PTH    BOARD     MTG   UNOWNED
.END_DRILLED_HOLES
.NOTES
  3500.0   3300.0     75.0   2500.0     "This component rotated 14 degrees"
   400.0   4400.0     75.0   3200.0     "Component height limited by enclosure
latch"
  1800.0    300.0     75.0   1700.0     "Do not move connectors!"
.END_NOTES
.PLACEMENT
        cs13_a          pn-cap                 C1
  4000.0   1000.0   100.0      0.0     TOP    PLACED
        cc1210         pn-cc1210               C2
  3000.0   3500.0     0.0      0.0     TOP    PLACED
        cc1210         pn-cc1210               C3
  3200.0   1800.0     0.0      0.0  BOTTOM    PLACED
        cc1210         pn-cc1210               C4
  1400.0   2300.0     0.0    270.0     TOP    PLACED
        cc1210         pn-cc1210               C5
  1799.5   3518.1     0.0      0.0  BOTTOM    PLACED
     conn_din24        connector               J1
  1800.0    100.0     0.0      0.0     TOP    MCAD
     conn_din24        connector               J2
  4400.0    100.0     0.0      0.0     TOP    MCAD
        plcc_20 pn-pal16l8-plcc                U1
  1800.0   3200.0     0.0      0.0  BOTTOM    ECAD
        plcc_20 pn-pal16l8-plcc                U2
  3200.0   1800.0     0.0      0.0     TOP    PLACED
        dip_14w    pn-hs346-dip                U3
  3000.0   3300.0     0.0     14.0     TOP    PLACED
        dip_14w    pn-hs346-dip                U4
  2200.0   2500.0     0.0    270.0     TOP    PLACED
.END_PLACEMENT
```

Chapter 3
Panel File Format

The panel file is an optional file, similar to the board file. It contains the physical description of a manufacturing step-and-repeat panel including the panel shape, layout restrictions, and the placement of boards and components on the panel. The panel file can contain any of the sections supported by the board file.

The panel file references one or more PCBs that are described in separate board files. This allows panels to have keepouts, keepins, and drilled holes. Any component placed on the panel is referenced in a library file.

Panel files contains the following sections:

Header — for information on the panel file

Board outline — for defining the outline, cutouts, and thickness of the panel

Other outline — for defining the outline, cutouts, and thickness of another outline

Route outline — for defining an area to route electrical connections

Place outline — for defining an area to place electrical components

Route keepout — for defining an area within which routing is not allowed

Via keepout — for defining an area within which vias are not allowed

Place keepout — for defining an area within which electrical components are not allowed

Place region — for defining an area to place similar electrical components

Drilled holes — for defining drilled holes in the panel

Notes — for defining annotations to communicate additional information between designers

Placement — for defining the locations of components on the board, or boards and components on the panel

The Header section must be the first section in the file. The Outline section must be the second section; and the Placement section must be the last section. All other sections can be in any order.

Panel File Header Section

This section contains information about the panel file.

Record 1

Field	Description	Type	Value
1	Section keyword	string	.HEADER

Record 2

Field	Description	Type	Value	
1	File type	string	PANEL_FILE	File contains panel information
2	IDF version number	float	1.0 2.0 3.0	First version Previous version This version
3	Source system identification	string	Any Example: "ACME CAD rel. 5.0"	
4	Date	string	format = yyyy/mm/dd.hh:mm:ss	
5	Panel File version #	integer	Any	

Record 3

Field	Description	Type	Value	
1	Panel name	string	Any	
2	Units definition	string	MM THOU	millimeters mils (thousandths of an inch)

The units specified in Field 2 apply to all values in the board or panel file.

Record 4

Field	Description	Type	Value
1	Section end keyword	string	.END_HEADER

Board Outline Section

This section defines the panel outline and its internal cutouts as a 2D profile with thickness. The outline and cutouts consist of simple closed curves made up of arcs and lines. Only one outline can be specified, but multiple cutouts are allowed.

Record 1

Field	Description	Type	Value	
1	Section keyword	string	.BOARD_OUTLINE .PANEL_OUTLINE	
2	Outline owner	string	MCAD	Outline is owned by the Mechanical system and must not be modified in the Electrical system.
			ECAD	Outline is owned by the Electrical system and must not be modified in the Mechanical system.
			UNOWNED	Outline can be modified in either system.

Record 2

Field	Description	Type	Value
1	Board thickness	float	Any

The thickness of a panel must be the same as the boards it contains.

Record 3

Field	Description	Type	Value	
1	Loop label	integer	0	Specifies panel outline points in a counter-clockwise direction.
			1	Specifies panel cutout points in clockwise direction.
			n	Labels additional panel cutouts sequentially from one.
2	X coordinate of point	float	Any	
3	Y coordinate of point	float	Any	
4	Include angle (degrees)	float	0	Creates a straight line between X_{n-1}, Y_{n-1} and X_n, Y_n.
			#0	Creates an arc between X_{n-1}, Y_{n-1} and X_n, Y_n. If positive, the arc is counter-clockwise.
			360	Creates a circle with the center at X_{n-1}, Y_{n-1} with X_n, Y_n a point on the circle. A circle is considered an entire loop.

Record 3 is repeated for each point that defines the panel outline or a cutout on the panel. For each loop (outline or cutout), the last pair of coordinates must be the same as the first.

Record 4

Field	Description	Type	Value
1	Section end keyword	string	.END_BOARD_OUTLINE .END_PANEL_OUTLINE

Other Outline Section

This section defines an additional outline with cutouts that can be used for other purposes than the panel outline such as for defining a heatsink or board core. The outline and cutouts consist of simple closed curves made up of arcs and lines. Multiple other outline sections can be specified.

Record 1

Field	Description	Type	Value	
1	Section keyword	string	.OTHER_OUTLINE	
2	Outline owner	string	MCAD	Outline is owned by the Mechanical system and must not be modified in the Electrical system.
			ECAD	Outline is owned by the Electrical system and must not be modified in the Mechanical system.
			UNOWNED	Outline can be modified in either system.

Record 2

Field	Description	Type	Value	
1	Outline identifier	float	Any	Unique identifier for the outline, such as a part name or layer name
2	Extrude thickness	float	Any ($\geq$0)	
3	panel side	string	TOP	Other outline is on top of the panel.
			BOTTOM	Other outline is on the bottom of the panel.

Record 3

Field	Description	Type	Value	
1	Loop label	integer	0	Specifies outline points in counter-clockwise direction.
			1	Specifies cutout points in clockwise direction.
			n	Additional cutouts labeled sequentially from one.
2	X coordinate of point	float	Any	
3	Y coordinate of point	float	Any	

Field	Description	Type	Value	
4	Include angle (degrees)	float	0	Creates a straight line between X_{n-1}, Y_{n-1} and X_n, Y_n.
			#0	Creates an arc between X_{n-1}, Y_{n-1}, and X_n, Y_n. If positive, the arc is counter-clockwise.
			360	Creates a circle with the center at X_{n-1}, Y_{n-1} with X_n, Y_n a point on the circle. A circle is considered an entire loop.

Record 3 is repeated for each point that defines the outline or its cutouts on the board. For each loop (outline or cutout), the last pair of coordinates must be the same as the first.

Record 4

Field	Description	Type	Value
1	Section end keyword	string	.END_OTHER_OUTLINE

Routing Outline Section

This section defines a routing outline for the board or panel. Each routing outline specifies a region within which routing must be confined, and consists of a simple closed curve made up of arcs and lines. Portions of routing outlines on a panel that lie on a board in the panel are inherited by that board. Multiple routing outlines can be defined.

Record 1

Field	Description	Type	Value	
1	Section keyword	string	.ROUTE_OUTLINE	
2	Outline owner	string	MCAD	Outline is owned by the Mechanical system and must not be modified in the Electrical system.
			ECAD	Outline is owned by the Electrical system and must not be modified in the Mechanical system.
			UNOWNED	Outline can be modified in either system.

Record 2

Field	Description	Type	Value	
1	Routing layers	string	TOP	Outline applies to top routing layer only.
			BOTTOM	Outline applies to bottom routing layer only.
			BOTH	Outline applies to both top and bottom routing layers only.
			INNER	Outline applies to the inner routing layers of the board only.
			ALL	Outline applies to all routing layers.

Record 3

Field	Description	Type	Value	
1	Loop label	integer	0	Specifies routing outline points in counter-clockwise direction.
			1	Specifies board cutout points in clockwise direction.
2	X coordinate of point	float	Any	
3	Y coordinate of point	float	Any	

Field	Description	Type	Value	
4	Include angle (degrees)	float	0	Creates a straight line between X_{n-1}, Y_{n-1} and X_n, Y_n.
			#0	Creates an arc between X_{n-1}, Y_{n-1} and X_n, Y_n. If positive, the arc is counter-clockwise.
			360	Creates a circle with the center at X_{n-1}, Y_{n-1} with X_n, Y_n a point on the circle. A circle is considered an entire loop.

Record 3 is repeated for each point that defines the outline or its cutouts on the board. For each loop (outline or cutout), the last pair of coordinates must be the same as the first.

Record 4

Field	Description	Type	Value
1	Section end keyword	string	.END_ROUTE_OUTLINE

Placement Outline Section

This section defines a placement outline for the board or panel. Each placement outline specifies a region within which components must be placed, and consists of a simple closed curve made up of arcs and lines plus a height restriction. Portions of placement outlines on a panel that lie on a board in the panel are inherited by that board. Multiple placement outlines can be defined.

Record 1

Field	Description	Type	Value	
1	Section keyword	string	.PLACE_OUTLINE	
2	Outline owner	string	MCAD	Outline is owned by the Mechanical system and must not be modified in the Electrical system.
			ECAD	Outline is owned by the Electrical system and must not be modified in the Mechanical system.
			UNOWNED	Outline can be modified in either system.

Record 2

Field	Description	Type	Value	
1	Board side	string	TOP	Outline applies to top side of board only.
			BOTTOM	Outline applies to bottom side of board only.
			BOTH	Outline applies to both sides of board.
2	Outline height	float	Any (≥ 0)	

The outline height is used to exclude components from the outline that, when mounted, exceed this height. If this field is missing, there is no height restriction on the outline.

Record 3

Field	Description	Type	Value	
1	Loop label	integer	0	Specifies placement outline points in counter-clockwise direction.
			1	Specifies board cutout points in clockwise direction.
2	X coordinate of point	float	Any	
3	Y coordinate of point	float	Any	
4	Include angle (degrees)	float	0	Creates a straight line between X_{n-1}, Y_{n-1} and X_n, Y_n.
			#0	Creates an arc between X_{n-1}, Y_{n-1} and X_n, Y_n. If positive, the arc is counter-clockwise.
			360	Creates a circle with the center at X_{n-1}, Y_{n-1} with X_n, Y_n a point on the circle. A circle is considered an entire loop.

Record 3 is repeated for each point that defines the placement outline. The last pair of coordinates must be the same as the first.

Record 4

Field	Description	Type	Value
1	Section end keyword	string	.END_PLACE_OUTLINE

Routing Keepout Section

This section defines a routing keepout for the board or panel. Routing keepouts specify regions where routing is not allowed. Routing keepouts can exist on top, bottom, both top and bottom, or all routing layers. Each keepout consists of a simple closed curve made up of arcs and lines. Portions of routing keepouts on a panel that lie on a board in the panel are inherited by that board. Multiple keepouts are allowed.

Record 1

Field	Description	Type	Value	
1	Section keyword	string	.ROUTE_KEEPOUT	
2	Keepout owner	string	MCAD	Keepout is owned by the Mechanical system and must not be modified in the Electrical system.
			ECAD	Keepout is owned by the Electrical system and must not be modified in the Mechanical system.
			UNOWNED	Keepout can be modified in either system.

Record 2

Field	Description	Type	Value	
1	Routing layers	string	TOP	Keepout applies to top routing layer only,
			BOTTOM	Keepout applies to bottom routing layer only.
			BOTH	Keepout applies to both top and bottom routing layers only.
			INNER	Keepout applies to the inner routing layers of the board only.
			ALL	Keepout applies to all routing layers.

Record 3

Field	Description	Type	Value	
1	Loop label	integer	0	Specifies routing keepout points in counter-clockwise direction.
			1	Specifies board cutout points in clockwise direction.
2	X coordinate of point	float	Any	
3	Y coordinate of point	float	Any	

Field	Description	Type	Value	
4	Include angle (degrees)	float	0	Creates a straight line between X_{n-1}, Y_{n-1} and X_n, Y_n.
			#0	Creates an arc between X_{n-1}, Y_{n-1} and X_n, Y_n. If positive, the arc is counter-clockwise.
			360	Creates a circle with the center at X_{n-1}, Y_{n-1} with X_n, Y_n a point on the circle. A circle is considered an entire loop.

Record 3 is repeated for each point that defines the routing keepout. The last pair of coordinates must be the same as the first.

Record 4

Field	Description	Type	Value
1	Section end keyword	string	.END_ROUTE_KEEPOUT

Via Keepout Section

This section defines a via keepout for the board or panel. Via keepouts specify regions where vias are not allowed (although routing is still allowed). Each keepout consists of a simple closed curve made up of arcs and lines. Portions of via keepouts on a panel that lie on a board in the panel are inherited by that board. Multiple via keepouts are allowed. Only through vias (vias that go all the way through the board) are supported.

Record 1

Field	Description	Type	Value	
1	Section keyword	string	.VIA_KEEPOUT	
2	Keepout owner	string	MCAD	Keepout is owned by the Mechanical system and must not be modified in the Electrical system.
			ECAD	Keepout is owned by the Electrical system and must not be modified in the Mechanical system.
			UNOWNED	Keepout can be modified in either system.

Record 2

Field	Description	Type	Value	
1	Loop label	integer	0	Specifies points in counter-clockwise direction.
			1	Specifies points in clockwise direction.
2	X coordinate of point	float	Any	Relative to the board or panel origin
3	Y coordinate of point	float	Any	Relative to the board or panel origin
4	Include angle (degrees)	float	0	Creates a straight line d between X_{n-1}, Y_{n-1} and X_n, Y_n.
			#0	Creates an arc between X_{n-1}, Y_{n-1} and X_n, Y_n. If positive, the arc is counter-clockwise.
			360	Creates a circle with the center at X_{n-1}, Y_{n-1} with X_n, Y_n a point on the circle. A circle is considered an entire loop.

Record 2 is repeated for each point that defines the via keepout. The last pair of coordinates must be the same as the first.

Record 3

Field	Description	Type	Value
1	Section end keyword	string	.END_VIA_KEEPOUT

Drilled Holes Section

This section specifies holes to drill in the panel for mounting or tooling purposes. Drilled holes are distinguished from circular cutouts in the panel outline as they are always drilled (not punched or routed) and can be plated with conductor. This section only appears once in the panel file, but multiple, non-overlapping holes are allowed.

Record 1

Field	Description	Type	Value
1	Section keyword	string	.DRILLED_HOLES

Record 2

Field	Description	Type	Value	
1	Hole diameter	float	Any	
2	X coordinate of center	float	Any	
3	Y coordinate of center	float	Any	
4	Plating style	string	PTH	Plated (conducting) through hole.
			NPTH	Non-plated (non-conducting) through hole
5	Associated parts	string	BOARD	Defines a hole in the board part.
			NOREFDES	Defines a hole in a non-electrical part.
			PANEL	Defines a hole in the panel part.
			Reference Designator	Reference designator of electrical component in which hole is defined
6	Hole type	string	PIN	Hole is for a component pin.
			VIA	Hole is for a conductive via.
			MTG	Hole is for mounting purposes.
			TOOL	Hole is for tooling purposes.
			Other	User-defined.
7	Hole owner	string	MCAD	Hole is owned by the Mechanical system and must not be modified in the Electrical system.
			ECAD	Hole is owned by the Electrical system and must not be modified in the Mechanical system
			UNOWNED	Hole can be modified in either system

All X and Y coordinate values are absolute (relative to the board or panel origin). Record 2 is repeated for each drilled hole.

Record 3

Field	Description	Type	Value
1	Section end keyword	string	.END_DRILLED_HOLES

Notes Section

This section contains notes for the design that can be displayed in the receiving system, to allow the electrical and mechanical designers to communicate additional information about the design entities beyond that conveyed by the entities themselves. Notes are not intended for rigorous translations of text such as for transferring manufacturing drawings. The association of a note to its subject is inferred by its location.

Record 1

Field	Description	Type	Value
1	Section keyword	string	.NOTES

Record 2

Field	Description	Type	Value	
1	X coordinate of text	float	Any	Bottom left justification is assumed.
2	Y coordinate of text	float	Any	Bottom left justification is assumed.
3	Text height	float	Any	Board or panel units are assumed.
4	Text string physical length	float	Any	Board or panel units are assumed.
5	Text value	string	Any	

Record 3

Field	Description	Type	Value
1	Section end keyword	string	.END_NOTES

Placement Keepout Section

This section defines a placement keepout for the board or panel. Placement keepouts specify regions on the board where components cannot be placed. A keepout can apply to all components, or to only those components above a specified height. Placement keepouts can exist on the top, bottom, or both top and bottom of the board or panel. Each keepout consists of a simple closed curve made up of arcs and lines along with a height restriction. Portions of placement keepouts on a panel that lie on a board in the panel are inherited by that board. Multiple keepouts are allowed.

Record 1

Field	Description	Type	Value	
1	Section keyword	string	.PLACE_KEEPOUT	
2	Keepout owner	string	MCAD	Keepout is owned by the Mechanical system and must not be modified in the Electrical system
			ECAD	Keepout is owned by the Electrical system and must not be modified in the Mechanical system.
			UNOWNED	Keepout can be modified in either system.

Record 2

Field	Description	Type	Value	
1	Board side	string	TOP	Keepout applies to top side of board only.
			BOTTOM	Keepout applies to bottom side of board only.
			BOTH	Keepout applies to both sides of board.
2	Keepout height	float	Any (≥ 0)	

The keepout height is used to exclude components from the keepout that, when mounted, exceed this height. A value of 0.0 excludes all components from the keepout.

Record 3

Field	Description	Type	Value	
1	Loop label	integer	0	Specifies placement keepout points in counter-clockwise direction.
			1	Specifies board cutout points in clockwise direction.
2	X coordinate of point	float	Any	Relative to the board or panel origin
3	Y coordinate of point	float	Any	Relative to the board or panel origin
4	Include angle (degrees)	float	0	Creates a straight line between X_{n-1}, Y_{n-1} and X_n, Y_n.
			#0	Creates an arc between X_{n-1}, Y_{n-1} and X_n, Y_n. If positive, the arc is counter-clockwise.
			360	Creates a circle with the center at X_{n-1}, Y_{n-1} with X_n, Y_n a point on the circle. A circle is considered an entire loop.

Record 3 is repeated for each point that defines the placement keepout. The last pair of coordinates must be the same as the first.

Record 4

Field	Description	Type	Value
1	Section end keyword	string	.END_PLACE_KEEPOUT

Board and Component Placement Section

This section specifies the locations of all components on the board, and boards and components on a panel. A location consists of an X coordinate and Y coordinate relative to the board or panel origin, a mounting offset, a rotation about the component origin, and a side of the board or panel. Components can be either placed or unplaced. Placed components can be owned by the system (electrical or mechanical) that specified their locations to prevent changes being made to their placement in the receiving system.

The package name and part number fields in Record 2 for each component are used to reference the component description in the library file.

Record 1

Field	Description	Type	Value
1	Section keyword	string	.PLACEMENT

Record 2

Field	Description	Type	Value	
1	Package name	string	Any	Board or component geometry name
2	Part number	string	Any	Component part number
3	Reference Designator	string	Any	Electrical component instance reference designator.
			NOREFDES	Instance is a mechanical component.
			BOARD	Instance is a board on a panel.

Record 3

Field	Description	Type	Value	
1	X coordinate of location	float	Any	
2	Y coordinate of location	float	Any	
3	Mounting offset	float	Any (≥ 0) Mounting offset from panel surface	
4	Rotation angle (degrees)	float	Any	
5	Side of panel	string	TOP	Component or board is placed on the top of the panel.
			BOTTOM	Component or board is placed on the bottom of the panel.

Field	Description	Type	Value	
6	Placement status	string	FIXED	Component location is fixed and cannot be moved
			UNPLACED	Component is currently unplaced.
			PLACED	Component is placed but not fixed.
			MCAD	Component or board is owned by the Mechanical system and must not be modified in the Electrical system
			ECAD	Component or board is owned by the Electrical system and must not be modified in the Mechanical system.
			UNOWNED	Component or board can be modified in either system.

A component is located by first moving its origin to the specified X,Y coordinates. (All X and Y coordinate values are absolute, relative to the board or panel origin). If the component is on the bottom of the board or panel, it is flipped around its local Y axis. Finally, the component is rotated the specified amount about its origin (positive rotations are counter-clockwise, relative to the component's coordinate system).

If the value of field 6 of record 3 is UNPLACED, the values in fields 1-5 are ignored. Records 2 and 3 are repeated for each component on the board.

Record 4

Field	Description	Type	Value
1	Section end keyword	string	.END_PLACEMENT

Panel File Example

```
.HEADER
PANEL_FILE  3.0  "Sample File Generator"  10/22/96.16:20:19  1
sample_panel   THOU
.END_HEADER
.PANEL_OUTLINE          MCAD
62.0
0       0.0      0.0      0.0
0   16000.0      0.0      0.0
0   16000.0 12000.0      0.0
0       0.0 12000.0      0.0
0       0.0      0.0      0.0
.END_PANEL_OUTLINE
.PLACE_KEEPOUT          MCAD
BOTTOM          0.0
0   13500.0      0.0      0.0
0   16000.0      0.0      0.0
0   16000.0 12000.0      0.0
0   13500.0 12000.0      0.0
0   13500.0      0.0      0.0
.END_PLACE_KEEPOUT
.PLACE_KEEPOUT          MCAD
BOTTOM          0.0
0       0.0      0.0      0.0
0    2200.0      0.0      0.0
0    2200.0 12000.0      0.0
0       0.0 12000.0      0.0
0       0.0      0.0      0.0
.END_PLACE_KEEPOUT
.DRILLED_HOLES
   250.0 15500.0 11500.0     NPTH    PANEL    TOOL    MCAD
   250.0    500.0 11500.0     NPTH    PANEL    TOOL    MCAD
   250.0    500.0    500.0     NPTH    PANEL    TOOL    MCAD
.END_DRILLED_HOLES
.PLACEMENT
    sample_board          pn-board              BOARD
  1700.0  3300.0      0.0      0.0     TOP    MCAD
    sample_board          pn-board              BOARD
 14000.0  3300.0      0.0      0.0  BOTTOM    MCAD
.END_PLACEMENT
```

Chapter 4
Library File Format

The library file contains definitions for each unique electrical and mechanical component (based on part number) used in the printed circuit board. The component definitions in the library file are referenced by their part numbers in the board file.

Each component definition includes an outline and a height, which can be used by the receiving mechanical system to extrude approximate solid models of the components. Detailed models of some or all of the components can be substituted for the extruded shapes in the mechanical system. The ability to perform this substitution is a function of the mechanical system, not IDF.

The library file contains the following sections:

> **Header** — for information on the library file
>
> **Electrical** — for defining an electrical component
>
> **Mechanical —** for defining a mechanical component

The Header section must be the first section in the file; Electrical and Mechanical sections can be in any order after the Header section.

The following pages describe these sections. Also, refer to "Library File Example".

Library File Header Section

This section contains information on the library file

Record 1

Field	Description	Type	Value
1	Section keyword	string	.HEADER

Record 2

Field	Description	Type	Value
1	File type	string	BOARD_FILE
2	IDF version number	float	1.0 First version 2.0 Previous version 3.0 This version
3	Source system identification	string	Any Example: "ACME CAD rel. 5.0"
4	Date	string	format = yyyy/mm/dd.hh:mm:ss
5	Board File version #	integer	Any

Record 3

Field	Description	Type	Value
1	Section end keyword	string	.END_HEADER

Electrical Component Section

This section defines an electrical component on the PCB. An electrical component is defined as being electrically connected to other electrical components in the PCB, such as resistors, connectors, and IC packages. The outline of an electrical component consists of a simple closed curve made up of arcs and lines. The library file contains an electrical component section for each electrical part number in the PCB.

Record 1

Field	Description	Type	Value
1	Section keyword	string	.ELECTRICAL

Record 2

Field	Description	Type	Value
1	Geometry name	string	Any
2	Part number	string	Any
3	Units definition	string	MM millimeters THO mils (thousandths of an inch)
4	Component height	float	Any

The units definition applies to this component only.

Record 3

Field	Description	Type	Value	
1	Loop label	integer	0	Specifies points in counter-clockwise direction
			1	Specifies points in clockwise direction
2	X coordinate of point	float	Any	Relative to the component origin.
3	Y coordinate of point	float	Any	Relative to the component origin.
4	Include angle (degrees)	float	0	Creates a straight line between X_{n-1}, Y_{n-1} and X_n, Y_n.
			#0	Creates an arc between X_{n-1}, Y_{n-1} and X_n, Y_n. If positive, the arc is counter-clockwise.
			360	Creates a circle with the center at X_{n-1}, Y_{n-1} with X_n, Y_n a point on the circle. A circle is considered an entire loop.

Record 3 is repeated for each point that defines the component outline. The last pair of coordinates must be the same as the first.

Record 4

Field	Description	Type	Value	
1	Property keyword	string	PROP	
2	Property name	string	CAPACITANCE RESISTANCE TOLERANCE POWER_OPR POWER_MAX THERM_COND THETA_JB THETA_JC Other	Capacitance, microfarads Resistance, ohms Tolerance, % deviation Operating power rating, Milliwatts Maximum power rating, Milliwatts Thermal conductivity, Watt/meter^{o}C Junction to board thermal resistance, ^{o}C/Watt Junction to case thermal resistance, ^{o}C/Watt User-defined
3	Property value	string	Any	

This is an optional record that specifies properties for the component. Property records must follow the component outline records (record 3) and must be grouped.

Record 5

Field	Description	Type	Value
1	Section end keyword	string	.END_ELECTRICAL

Mechanical Component Section

This section defines a mechanical component on the PCB. A mechanical component has no electrical connectivity to other components in the PCB. Examples of mechanical components include card extractors, stiffeners, and mounting hardware. The outline of a mechanical component consists of a simple closed curve made up of arcs and lines. The library file contains a mechanical component section for each mechanical part number in the PCB.

Record 1

Field	Description	Type	Value
1	Section keyword	string	.MECHANICAL

Record 2

Field	Description	Type	Value
1	Geometry name	string	Any
2	Part number	string	Any
3	Units definition	string	MM millimeters THOU mils (thousandths of an inch)
4	Component height	float	Any

The units definition applies to this component only. The value contained in field 4 is interpreted as the height of the component at 0 mounting offset.

Record 3

Field	Description	Type	Value	
1	Loop label	integer	0	Specifies points in counter-clockwise direction
			1	Specifies points in clockwise direction
2	X coordinate of point	float	Any	Relative to the component origin.
3	Y coordinate of point	float	Any	Relative to the component origin
4	Include angle (degrees)	float	0	Creates a straight line between X_{n-1}, Y_{n-1} and X_n, Y_n.
			#0	Creates an arc between X_{n-1}, Y_{n-1} and X_n, Y_n. If positive, the arc is counter-clockwise.
			360	Creates a circle with the center at X_{n-1}, Y_{n-1} with X_n, Y_n a point on the circle. A circle is considered an entire loop.

Record 3 is repeated for each point that defines the component outline. The last pair of coordinates must be the same as the first.

Record 4

Field	Description	Type	Value
1	Section end keyword	string	.END_MECHANICAL

Library File Example

```
.HEADER
LIBRARY_file  3.0   "Sample File Generator"  10/22/96.16:41:37  1
.END_HEADER
.ELECTRICAL
          cs13_a           pn-cap    THOU   150.0
0    -55.0    55.0      0.0
0    -55.0   -55.0      0.0
0    135.0   -55.0      0.0
0    135.0   -80.0      0.0
0    565.0   -80.0      0.0
0    565.0   -55.0      0.0
0    755.0   -55.0      0.0
0    755.0    55.0      0.0
0    565.0    55.0      0.0
0    565.0    80.0      0.0
0    135.0    80.0      0.0
0    135.0    55.0      0.0
0    -55.0    55.0      0.0
PROP CAPACITANCE    100.0
PROP   TOLERANCE      5.0
.END_ELECTRICAL
.ELECTRICAL
          cc1210       pn-cc1210    THOU    67.0
0    -40.0    56.0      0.0
0    -40.0   -56.0      0.0
0    182.0   -56.0      0.0
0    182.0    56.0      0.0
0    -40.0    56.0      0.0
PROP CAPACITANCE      0.1
PROP   TOLERANCE      5.0
.END_ELECTRICAL
.ELECTRICAL
       conn_din24      connector    THOU   435.0
0   -1400.0  -500.0     0.0
0    300.0  -500.0      0.0
0    300.0   150.0      0.0
0   -1400.0   150.0     0.0
0   -1400.0  -500.0     0.0
.END_ELECTRICAL
.ELECTRICAL
        dip_14w    pn-hs346-dip    THOU   200.0
0    350.0    50.0      0.0
0    -50.0    50.0      0.0
0    -50.0  -650.0      0.0
0    350.0  -650.0      0.0
0    350.0    50.0      0.0
.END_ELECTRICAL
.ELECTRICAL
        plcc_20 pn-pal16l8-plcc    THOU    14.0
0   -200.0   240.0      0.0
0   -240.0   200.0      0.0
0   -240.0  -240.0      0.0
0    240.0  -240.0      0.0
0    240.0   240.0      0.0
0   -200.0   240.0      0.0
```

```
.END_ELECTRICAL
.ELECTRICAL
lcc32              IDT-71256s55LB.l    THOU      140.00000
0          -232.00000         65.00000       0
0          -280.00000         17.00000       0
0          -280.00000        -615.00000      0
0           280.00000        -615.00000      0
0           280.00000         65.00000       0
0          -232.00000         65.00000       0
.END_ELECTRICAL
.MECHANICAL
extractor          pn-extractor       thou      100.00000
0          -200.00000          0.00000       0
0          -200.00000        300.00000       0
0          1000.00000        300.00000       0
0          1300.00000        500.00000       0
0          1350.00000        450.00000       90.00000
0          1300.00000        500.00000       0
0           800.00000        100.00000       0
0             0.00000        200.00000       0
0          -200.00000          0.00000       90.00000
.END_MECHANICAL
```

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10. **HAZARDOUS APPLICATIONS.** CUSTOMER ACKNOWLEDGES IT IS SOLELY RESPONSIBLE FOR TESTING ITS PRODUCTS USED IN APPLICATIONS WHERE THE FAILURE OR INACCURACY OF ITS PRODUCTS MIGHT RESULT IN DEATH OR PERSONAL INJURY ("HAZARDOUS APPLICATIONS"). NEITHER MENTOR GRAPHICS NOR ITS LICENSORS SHALL BE LIABLE FOR ANY DAMAGES RESULTING FROM OR IN CONNECTION WITH THE USE OF MENTOR GRAPHICS PRODUCTS IN OR FOR HAZARDOUS APPLICATIONS. THE PROVISIONS OF THIS SECTION 10 SHALL SURVIVE THE TERMINATION OF THIS AGREEMENT.

11. **INDEMNIFICATION.** CUSTOMER AGREES TO INDEMNIFY AND HOLD HARMLESS MENTOR GRAPHICS AND ITS LICENSORS FROM ANY CLAIMS, LOSS, COST, DAMAGE, EXPENSE OR LIABILITY, INCLUDING ATTORNEYS' FEES, ARISING OUT OF OR IN CONNECTION WITH THE USE OF PRODUCTS AS DESCRIBED IN SECTION 10. THE PROVISIONS OF THIS SECTION 11 SHALL SURVIVE THE TERMINATION OF THIS AGREEMENT.

12. **INFRINGEMENT.**

   12.1. Mentor Graphics will defend or settle, at its option and expense, any action brought against Customer in the United States, Canada, Japan, or member state of the European Union which alleges that any standard, generally supported Product acquired by Customer hereunder infringes a patent or copyright or misappropriates a trade secret in such jurisdiction. Mentor Graphics will pay costs and damages finally awarded against Customer that are attributable to the action. Customer understands and agrees that as conditions to Mentor Graphics' obligations under this section Customer must: (a) notify Mentor Graphics promptly in writing of the action; (b) provide Mentor Graphics all reasonable information and assistance to settle or defend the action; and (c) grant Mentor Graphics sole authority and control of the defense or settlement of the action.

12.2. If a claim is made under Subsection 12.1 Mentor Graphics may, at its option and expense, (a) replace or modify the Product so that it becomes noninfringing; (b) procure for Customer the right to continue using the Product; or (c) require the return of the Product and refund to Customer any purchase price or license fee paid, less a reasonable allowance for use.

12.3. Mentor Graphics has no liability to Customer if the action is based upon: (a) the combination of Software or hardware with any product not furnished by Mentor Graphics; (b) the modification of the Product other than by Mentor Graphics; (c) the use of other than a current unaltered release of Software; (d) the use of the Product as part of an infringing process; (e) a product that Customer makes, uses, or sells; (f) any Beta Code or Product provided at no charge; (g) any software provided by Mentor Graphics' licensors who do not provide such indemnification to Mentor Graphics' customers; or (h) infringement by Customer that is deemed willful. In the case of (h), Customer shall reimburse Mentor Graphics for its reasonable attorney fees and other costs related to the action.

12.4. THIS SECTION 12 IS SUBJECT TO SECTION 9 ABOVE AND STATES THE ENTIRE LIABILITY OF MENTOR GRAPHICS AND ITS LICENSORS FOR DEFENSE, SETTLEMENT AND DAMAGES, AND CUSTOMER'S SOLE AND EXCLUSIVE REMEDY, WITH RESPECT TO ANY ALLEGED PATENT OR COPYRIGHT INFRINGEMENT OR TRADE SECRET MISAPPROPRIATION BY ANY PRODUCT PROVIDED UNDER THIS AGREEMENT.

13. **TERMINATION AND EFFECT OF TERMINATION.** If a Software license was provided for limited term use, such license will automatically terminate at the end of the authorized term.

13.1. Mentor Graphics may terminate this Agreement and/or any license granted under this Agreement immediately upon written notice if Customer: (a) exceeds the scope of the license or otherwise fails to comply with the licensing or confidentiality provisions of this Agreement, or (b) becomes insolvent, files a bankruptcy petition, institutes proceedings for liquidation or winding up or enters into an agreement to assign its assets for the benefit of creditors. For any other material breach of any provision of this Agreement, Mentor Graphics may terminate this Agreement and/or any license granted under this Agreement upon 30 days written notice if Customer fails to cure the breach within the 30 day notice period. Termination of this Agreement or any license granted hereunder will not affect Customer's obligation to pay for Products shipped or licenses granted prior to the termination, which amounts shall be payable immediately upon the date of termination.

13.2. Upon termination of this Agreement, the rights and obligations of the parties shall cease except as expressly set forth in this Agreement. Upon termination, Customer shall ensure that all use of the affected Products ceases, and shall return hardware and either return to Mentor Graphics or destroy Software in Customer's possession, including all copies and documentation, and certify in writing to Mentor Graphics within ten business days of the termination date that Customer no longer possesses any of the affected Products or copies of Software in any form.

14. **EXPORT.** The Products provided hereunder are subject to regulation by local laws and United States government agencies, which prohibit export or diversion of certain products and information about the products to certain countries and certain persons. Customer agrees that it will not export Products in any manner without first obtaining all necessary approval from appropriate local and United States government agencies.

15. **U.S. GOVERNMENT LICENSE RIGHTS.** Software was developed entirely at private expense. All Software is commercial computer software within the meaning of the applicable acquisition regulations. Accordingly, pursuant to US FAR 48 CFR 12.212 and DFAR 48 CFR 227.7202, use, duplication and disclosure of the Software by or for the U.S. Government or a U.S. Government subcontractor is subject solely to the terms and conditions set forth in this Agreement, except for provisions which are contrary to applicable mandatory federal laws.

16. **THIRD PARTY BENEFICIARY.** Mentor Graphics Corporation, Mentor Graphics (Ireland) Limited, Microsoft Corporation and other licensors may be third party beneficiaries of this Agreement with the right to enforce the obligations set forth herein.

17. **REVIEW OF LICENSE USAGE.** Customer will monitor the access to and use of Software. With prior written notice and during Customer's normal business hours, Mentor Graphics may engage an internationally recognized accounting firm to review Customer's software monitoring system and records deemed relevant by the internationally recognized accounting firm to confirm Customer's compliance with the terms of this Agreement or U.S. or other local export laws. Such review may include FLEXlm or FLEXnet (or successor product) report log files that Customer shall capture and provide at Mentor Graphics' request. Customer shall make records available in electronic format and shall fully cooperate with data gathering to support the license review. Mentor Graphics shall bear the expense of any such review unless a material non-compliance is revealed. Mentor Graphics shall treat as confidential information all information gained as a result of any request or review and shall only use or disclose such information as required by law or to enforce its rights under this Agreement. The provisions of this Section 17 shall survive the termination of this Agreement.

18. **CONTROLLING LAW, JURISDICTION AND DISPUTE RESOLUTION.** The owners of certain Mentor Graphics intellectual property licensed under this Agreement are located in Ireland and the United States. To promote consistency around the world, disputes shall be resolved as follows: excluding conflict of laws rules, this Agreement shall be governed by and construed under the laws of the State of Oregon, USA, if Customer is located in North or South America, and the laws of Ireland if Customer is located outside of North or South America. All disputes arising out of or in relation to this Agreement shall be submitted to the exclusive jurisdiction of the courts of Portland, Oregon when the laws of Oregon apply, or Dublin, Ireland when the laws of Ireland apply. Notwithstanding the foregoing, all disputes in Asia arising out of or in relation to this Agreement shall be resolved by arbitration in Singapore before a single arbitrator to be appointed by the chairman of the Singapore International Arbitration Centre ("SIAC") to be conducted in the English language, in accordance with the Arbitration Rules of the SIAC in effect at the time of the dispute, which rules are deemed to be incorporated by reference in this section. This section shall not

restrict Mentor Graphics' right to bring an action against Customer in the jurisdiction where Customer's place of business is located. The United Nations Convention on Contracts for the International Sale of Goods does not apply to this Agreement.

19. **SEVERABILITY.** If any provision of this Agreement is held by a court of competent jurisdiction to be void, invalid, unenforceable or illegal, such provision shall be severed from this Agreement and the remaining provisions will remain in full force and effect.

20. **MISCELLANEOUS.** This Agreement contains the parties' entire understanding relating to its subject matter and supersedes all prior or contemporaneous agreements, including but not limited to any purchase order terms and conditions. Some Software may contain code distributed under a third party license agreement that may provide additional rights to Customer. Please see the applicable Software documentation for details. This Agreement may only be modified in writing by authorized representatives of the parties. Waiver of terms or excuse of breach must be in writing and shall not constitute subsequent consent, waiver or excuse.

Rev. 100615, Part No. 246066